Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A phototransistor, comprising:

a photo-sensitive semiconductor layer;

a barrier layer extending across an active region of the semiconductor layer ~~under or over the semiconductor layer~~;

a drain region laterally spaced from the active region ~~(24)~~ of the semiconductor layer;

a drain contact connected to the drain region;

a source layer on the other side of the barrier layer to the semiconductor layer;

a gate layer on the opposite side of the semiconductor layer to the barrier layer and laterally overlapping the barrier layer for controlling the barrier height of the barrier layer to control conduction of electrons and holes between the source layer and the active region; and

a gate insulator layer between the gate layer and the semiconductor layer;

wherein the ~~structure~~ phototransistor allows light incident on the phototransistor to reach the active region to create electron hole pairs in the active region, the holes accumulating at the barrier to change the effective barrier height and hence the current flow between source layer and drain region through the active region.

2. (Previously Presented) A phototransistor according to claim 1 wherein the source layer is of semiconductor doped to have the first conductivity type and the barrier layer is a semiconductor layer doped to have a second conductivity type opposite to the first conductivity type.

3. (Previously Presented) A phototransistor according to claim 2 further comprising a transparent source electrode connected to the source layer.

4. (Previously Presented) A phototransistor according to claim 1 wherein the barrier layer is an insulating barrier layer.

5. (Previously Presented) A phototransistor according to claim 4 wherein the source layer is a transparent source electrode.

6. (Currently Amended) A phototransistor according to ~~any preceding~~ claim 1 wherein the semiconductor layer is of doped amorphous silicon.

7. (Previously Presented) A phototransistor according to claim 1 wherein the effective barrier height of the barrier to electrons is be more than half the band gap.

8. (Currently Amended) A phototransistor array comprising:

an array of phototransistors ~~according to claim 1~~ arranged over a single substrate, each phototransistor including:

a photo-sensitive semiconductor layer;

a barrier layer extending across an active region of the semiconductor layer;

a drain region laterally spaced from the active region of the semiconductor layer;

a drain contact connected to the drain region;

a source layer on the other side of the barrier layer to the semiconductor layer;

a gate layer on the opposite side of the semiconductor layer to the barrier layer and laterally overlapping the barrier layer for controlling the barrier height of the barrier

layer to control conduction of electrons and holes between the source layer and the active region; and

a gate insulator layer between the gate layer and the semiconductor layer;

wherein the phototransistor allows light incident on the phototransistor to reach the active region to create electron hole pairs in the active region, the holes accumulating at the barrier to change the effective barrier height and hence the current flow between source layer and drain region through the active region.

9. (Previously Presented) A phototransistor array according to claim 8 further comprising thin-film electronics on the substrate.

10. (Currently Amended) A method of operation of a phototransistor ~~according to claim 1~~that includes a photo-sensitive semiconductor layer; a barrier layer extending across an active region of the semiconductor layer; a drain region laterally spaced from the active region of the semiconductor layer; a drain contact connected to the drain region; a source layer on the other side of the barrier layer to the semiconductor layer; a gate layer on the opposite side of the semiconductor layer to the barrier layer and laterally overlapping the barrier layer for controlling the barrier height of the barrier layer to control conduction of electrons and holes between the source layer and the active region; and a gate insulator layer between the gate layer and the semiconductor layer; wherein the phototransistor allows light incident on the phototransistor to reach the active region to create electron hole pairs in the active region, the holes accumulating at the barrier to change the effective barrier height and hence the current flow between source layer and drain region through the active region, the method comprising:

(a) applying a positive reset pulse to the gate to allow holes accumulated at the barrier to tunnel out into the source layer;

(b) applying a frame gate voltage to the gate during a frame period, the frame gate voltage allowing any electrons created by illumination in the active region to pass the barrier but allow any holes created by illumination in the active region ~~(24)~~ to accumulate at the barrier, thereby reducing the effective height of the barrier to electrons;

(c) reading the source-drain current as a measure of the illumination.

11. (Previously Presented) A method according to claim 10 comprising repeating steps (a) to (c) to measure the illumination over a series of frame periods.